How Safe Are Genetically Engineered Crops?

A lot of people around the world want to know the answer to the question posed in the title.

Here in the United States, genetically engineered (GE) crops have been grown on a large scale since the mid-1990s, with documented reductions in insecticide use and production costs. No discernible ill effects have shown up to offset these benefits. Not only that, but science promises a tremendous array of future advances, such as improved nutritional balance, elimination of trans fats, and enhanced disease resistance and cold tolerance.

So, what's the problem? With this relatively new technology of genetic engineering, naturally there are questions the public has never considered before, and people want some answers before they accept it. Some questions are obvious and have been thoroughly researched. For example, are these crops safe to humans and other species that inhabit Earth? Scientists measure the degree of safety by posing the question, "What is the risk?" Hence the origin of the science of risk assessment.

Risk is never perfectly controlled. Every activity in life carries some degree of risk. For example, we know that there were 42,815 highway fatalities in the United States in 2002, but we still get into our cars because we are familiar with that risk and we accept it for the benefits that our cars bring us.

Similarly, crops bred conventionally may carry risks, such as allergic reactions, but again we accept the risks. We also accept that some foods are riskier than others, and while we may handle them with more care, we still eat them.

Risk assessment basically consists of providing the answers to three questions: What can go wrong? How likely is it? How bad would it be? Risk analysis examines the answers and compares them to various alternatives so that the least risky pathway can be followed (risk management). Risk assessment is science. Risk management is art. It depends on the values and experiences of a society, which then decides which types and degrees of risks are acceptable and which are not.

This is where ARS research comes in. Research provides answers to the risk assessment questions. The answers may differ greatly depending on circumstances. For example, if genetic engineering simply moves a gene for a common food ingredient from one safe food crop to another, this does not expose consumers to new components in their food supply. The added risk to food safety is very small. But if a genetically engineered plant contains a pharmaceutical or other new compound that must be kept out of the food supply, the answers could be very different.

This is why ARS committed $24 million in fiscal year 2004 to biotechnology risk assessment and risk mitigation research, an increase of more than $8 million compared to fiscal year 2002. The research covers many topics, from assessing allergenicity of GE foods to blocking the movement of genes from GE crops to non-GE crops in the field. The story on page 4 gives a more in-depth look at this research.

Part of the reason for ARS to carry out risk assessment research is to provide data on the transgenic products of its own research projects. But there is more to it than that. ARS is supported by public tax dollars, and it takes on issues important to the public good that can't be done elsewhere. For example, ARS is monitoring insect resistance to *Bt* on behalf of the Environmental Protection Agency. (Some crops have been genetically engineered to contain *Bt,* a bacterium that controls certain insect pests.) It's a long-term, continuous effort that's national in scope and best done by a single organization. Data will be drawn from the *Bt* crop varieties of multiple seed companies, so it isn't research that a single company could carry out.

What happens when research detects a significant risk? If the product is important and there is no other way of producing it, then research to reduce risk is appropriate. ARS is developing several tools to decrease or eliminate some of the risks that might be associated with transgenics. For example, if a plant needs protection against a leaf-feeding pest, the protective agent need not also be present in the grain (that's harvested for food). The first defense against risk is to choose safe genes well and carefully and prove their suitability. A second line of defense is a risk mitigation strategy, in this case blocking accumulation of the new material in the grain. The technology to direct synthesis of these agents, such as *Bt,* to specific tissues is known and under development but not yet perfected.

ARS is not alone in carrying out risk assessment research. Companies that produce genetically engineered seeds or genes collect a lot of specific information about their products to prove safety. The public sector (USDA and state universities), however, generally takes a broader approach, attempting to bring out principles and issues beyond specific products. In addition to ARS's in-house research, USDA funds a competitively awarded grants program for research on biotechnology risk assessment. That program focuses on environmental risk and is supported by a 2-percent levy on all biotechnology research funded by USDA.

The aim of all this research is to provide useful and important agricultural products to feed and clothe the world—now and well into the future. If genetic engineering is to fulfill its potential, it must be the safest way to meet that lofty goal. Moreover, it must be accepted as such by the public that eats the food. Until both those goals are reached, our work is not done.

John W. Radin
ARS National Program Leader
Plant Physiology and Risk Assessment
Beltsville, Maryland